Rankine Power Plant Cycle Utilizing Ammonia with Surface and Deep-Water Heat Exchange.

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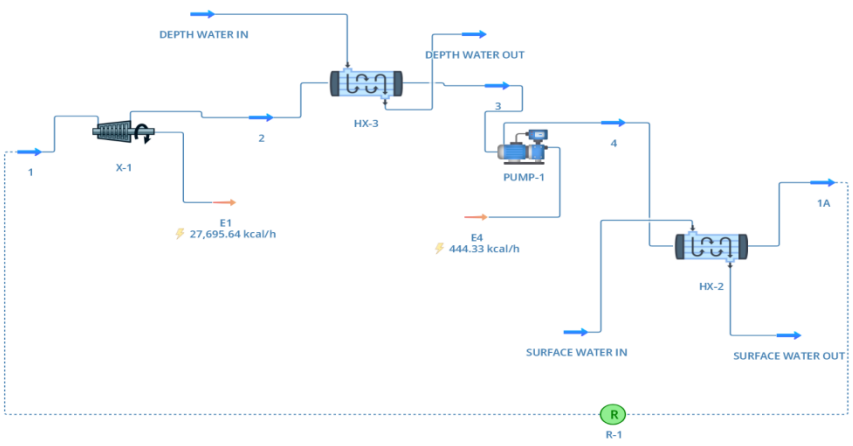
Abstract:

This simulation is of a Rankine cycle which is a thermodynamic process that uses the temperature difference of water between the surface and depth of a water body to generate power. There are four ammonia streams in the cycle, which are referred to as Streams 1, 2, 3, and 4. Stream 1 is the input stream that enters the turbine and produces energy, or work. Stream 2 flows into the heat exchanger and is cooled. Stream 3 is the ammonia stream that exits the heat exchanger and flows into the pump, where its pressure is increased. Stream 4 reaches the second heat exchanger and receives heat. This heat exchanger generates Stream 1A, which is recycled back. Surface and deep-water are the primary heat and coolants for ammonia.

Thermodynamic package: Peng-Robinson.

Flow sheet:



Results:

Properties	Unit	Stream				
		4	3	2	1A	1
Temperature	°C	10.077	9.99996	9.99996	20	20
Pressure	atm	8.43441	6.05127	6.05127	8.43441	8.43441
Mass Flow	g/s	1000	1000	1000	1000	1000
Molar Fraction (Vapor)	frac	0.0000	0.0000	0.9847	1.0000	1.0000

Properties	Unit	Stream			
		Surface water out	Surface water in	Depth water out	Depth water in
Temperature	°C	23.4342	25	7.04328	5
Pressure	atm	1	1	1	1
Mass Flow	g/s	180771	180771	35356.4	35356.4
Molar Fraction (Vapor)	frac	0.0000	0.0000	0.1901	0.1724

Reference: Claus Borgnakke Richard E. Sonntag (1998) Fundamentals of Thermodynamics (7th ed.) John Wiley & Sons.